

# SP-F2: Evaluation of Project Effects on Fish Diseases

**June 2004**

Eric See, DWR

Jerry Boles, DWR

Mary Louise Keefe, MWH

# Need for the Study

- Review information on establishment, transmission and control of fish diseases in Project waters
- Evaluate Project's effects on these processes, and on potential for fish diseases to move downstream of Project waters.
- Evaluate direct and indirect effects of Oroville Facilities on fish diseases, as required to comply with FERC environmental review process.

# Study Objectives

- Determine occurrence and distribution of significant diseases in Project waters, including IHN, ceratomyxosis, BKD, cold water disease, and whirling disease.
- Catalog fish species within Project area and evaluate their susceptibilities to diseases.
- Document the life history characteristics of the causative agents of the significant diseases and their mechanisms of disease transmission.
- Document methods of controlling significant diseases.

## Study Objectives (continued)

- For significant disease, identify salient environmental conditions that impact disease transmission.
- Evaluate effect of hatchery operations on disease transmission within Project area.
- Evaluate prevalence and potential for disease outbreak in Project area from current Project operations.
- Evaluate potential for fish diseases to spread downstream in the Feather River.
- Evaluate whether pump-back operations increase risk of disease because of fluctuating environmental conditions.

# Fish Species in Project Waters and Their Susceptibility to Disease

- Forty-four fish species (16 native and 28 exotic) are known to exist in Project waters.
- Project effects may increase or decrease susceptibility of fish species to diseases.
- These effects include changes in Feather River flow regime and water temperatures, increased lentic habitat, interference with natural migrations, historic stocking of exotic and game species (including predators and fish species with low resistance to endemic pathogens), and potential amplification of disease due to hatchery rearing.

## Fish Species in Project Waters and Their Susceptibility to Disease (continued)

- Species of salmonids that can be significantly affected by IHN include Chinook salmon, rainbow trout, sockeye salmon and kokanee.
- Rainbow trout and steelhead are normally highly susceptible to ceratomyxosis, while Chinook and coho salmon are more resistant to the disease.
- Ceratomyxosis is more problematic at higher water temperatures, while IHN is more problematic at lower water temperatures.

# Fish Pathogens and Diseases at Oroville Project Fish Facilities

Pathogen/Disease	Thermalito Annex	Feather River Hatchery
<i>Aeromonas hydrophila</i>	X	X
<i>Aeromonas spp.</i>	X	X
Capriniana (Trichophyra)	X	X
<b><i>Ceratomyxa shasta</i> (ceratomyxosis)</b>	X	X
Epistylis		X
<i>Flavobacterium branchiophilum</i>	X	X
<b><i>Flavobacterium columnare</i> (columnaris)</b>	X	X
<b><i>Flavobacterium psychrophilum</i> (cold water)</b>	X	
Gyrodactylus		X
Hexamita		X
<i>Ichthyobodo necatrix</i> (costia)	X	X
<i>Ichthyophthirius multifiliis</i> (white spot)	X	X
<b>Infectious Hematopoietic Necrosis (IHN)</b>	X	X
<i>Myxobacteria spp.</i>	X	X
<b><i>Myxobolus cerebralis</i> (whirling)</b>		
Paramyxovirus		X
<i>Pseudomonas fluorescens</i>	X	X
<i>Pseudomonas spp.</i>	X	X
<b><i>Renibacterium salmoninarum</i> (BKD)</b>	X	
<i>Tetracapsula bryosalmonae</i>	X	
<b><i>Yersinia ruckeri</i> (enteric red-mouth)</b>	X	X

Significant diseases indicated by bold text

## Fish Pathogens and Diseases at Oroville Project Fish Facilities (continued)

Pathogen/Disease	Thermalito Annex	Feather River Hatchery
<i>Miscellaneous</i>		
Gas bubble syndrome		X
Phoma		X
Saprolegnia		X

Source: Dr. Bill Cox, 2003



# Occurrence and Distribution of Significant Diseases in Project Waters

- Two most significant diseases of concern in Project waters are salmonid ceratomyxosis (*C. shasta*) and infectious hematopoietic necrosis (IHN virus).
- Cold water disease, enteric red mouth (ERM), bacterial kidney disease (BKD), and columnaris are also present in area, but have never caused significant disease outbreaks.
- Whirling disease is found in North and South Forks of the Feather River, but has not been detected in Project waters.
- Disease outbreaks in Project waters apparently are associated primarily with stocked hatchery fish.

## Temperature Conditions Favorable to Significant Fish Diseases in Project Area

Disease	Pathogen	Active Temperature Range (°F)	Temperature Conditions Favorable to Disease
BKD	<i>Renibacterium salmoninarum</i>	41° to 77°F	Optimum temperature is at 59° to 64°F and does not grow at 77°F.
Ceratomyxosis	<i>Ceratomyxa shasta</i>	39° and higher	The infection progresses faster at higher temperature. Fish can be infected at 39° to 43°F. Mortality occurs when the water temperature is greater than 50°F.
Cold Water Disease	<i>Flavobacterium psychrophilum</i>	41° to 65°F	The disease exist at 65°F or less and becomes severe at about 60°F.
Columnaris	<i>Flavobacterium columnare</i>	50° to 90°F	The disease is common in salmonids at temperatures above 59°F. The disease progresses faster at higher temperature.
Enteric Red Mouth	<i>Yersinia ruckeri</i>	49° to 99°F	Higher mortality at temperatures greater than 50°F.
IHN	IHN virus	Below 59°F	The disease is severe at 50°F. Outbreaks are rare when the temperature is above 59°F.

# Occurrence and Distribution of Diseases in Project Waters that are Not Actively Managed

- Diseases in Project waters that are not actively managed normally do not cause significant mortality and are easier to treat. Therefore, they do not pose threat to fish in basin.
- Little is known about warmwater fish disease occurrence in the Project waters or what effect fish disease may have on warmwater fish populations.
- It is believed that significant diseases likely to jeopardize the warmwater fishery are not currently present because the fishery is self sustaining.

# Feather River Hatchery and Significant Diseases

- FRH employs BMPs and protocols to avoid spread of diseases from hatchery.
- Some disease concerns at the FRH have been addressed by installation of ultraviolet treatment system, modifications to stocking of Lake Oroville, periodic pathology testing, and prescribed use of therapeutic treatments.
- Native salmonids exhibit some natural resistance to ceratomyxosis. Therefore, risk of *C. shasta* transmission to fish populations in Feather River below hatchery is minimal.
- Most available evidence regarding transmission of IHN suggests that wild fish populations are the natural hosts and reservoirs of infection and that risk of IHN transmission from hatchery to wild fish populations is low.

# Thermalito Complex and Significant Diseases

- Pumpback operations in Thermalito Complex, if they raise water temperatures, may reduce incidence of IHN and increase that of ceratomyxosis during warm months.
- Effect on pathogen survival of change in water temperature and other factors between Thermalito Complex and Lake Oroville is unknown.
- Interaction with FRH, increased water temperature in the Thermalito Complex could result in disease amplification at the FRH, but the use of a UV system at the FRH likely reduces the risk.

# Lake Oroville and Significant Diseases

- The combination of mixing fish species, stocking of fish species susceptible to disease, water quality conditions, and elevated water temperature in the summer may increase potential for disease outbreaks in the lake.
- FRH has discontinued stocking Chinook salmon in the reservoir because of concerns for IHN.

## Lower Feather River and Significant Diseases

- No evidence that disease outbreaks or disease-related fish kills have occurred downstream of the Project.
- Baseline information, such as distribution of IHN virus is lacking for the Feather River basin, although information does exist for *C. shasta*.